DEPARTMENT OF THE ARMY
Omaha District, Corps of Engineers
106 South 15th Street
Omaha, Nebraska 68102-1618

:NOTICE: Failure to acknowledge :
:all amendments may cause rejec- :
:tion of the bid. See FAR :
:52.214-3 of Section 00100 :

Solicitation No. W1928F 04 B 0002

Date of Issue: 12 Dec 2003
Date of Opening: 15 Jan 2004

Amendment No. 0002
08 January 2004

SUBJECT: Amendment No. 0002 to Specifications and Drawings for Construction of **Consolidated Lodging Facility, Phase IV, Minneapolis St. Paul - International Airport Air Force Reserve Station, MN.**
Solicitation No. W1928F 04 B 0002.

TO: Prospective Bidders and Others Concerned

Note: The landscape drawings were inadvertently left off the website. The website now has the landscape drawings available for downloading and printing. The landscape drawings are also on the CD.

1. The specifications and drawings for subject project are hereby modified as follows (revise all specification indices, attachment lists, and drawing indices accordingly).

a. Specifications. (Descriptive Changes.)

1) Section 00800 Page 3, paragraph 1.1, delete "not later than 360 calendar days after receipt of Notice to Proceed." And substitute "not later than the number of calendar days after receipt of Notice to Proceed as set out in completion Schedule below.

Completion Schedule

Description of Work	Calendar Days*	Liquidated Damage
All work complete except for Options O-1 and O-2	360	$800
Option O-1 and O-2	90	$1000

* Calendar Days from Notice to Proceed"

2) Section 00800 Page 3, paragraph 1.2, delete "shall pay liquidated damages to the Government in the amount of $800 for each calendar day of delay until the work is completed or accepted." and substitute "shall pay liquidated damages to the Government, the applicable sum as set out in the schedule above, for each calendar day of delay until the work is completed or accepted."

3) Section 00800 Page 15, add the following new paragraph:

"1.33 TIME EXTENSIONS (SEPT 2000)

Time extensions for contract changes will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements related to the changed work and that the remaining contract completion dates for all other portions of the work will not be altered. The change order also may provide an equitable readjustment of liquidated damages under the new completion schedule. (FAR 52.211-13)"

4) Section 01030 Page 2, under PART 3, delete "(Not Applicable)" and substitute the following:

"3.1 The Contractor shall complete abatement and demolition requirements for Options O-1 and O-2, within 90 calendar days after execution/award of the Options."

5) Section 02300, add the attached "Geotechnical Exploration And Review For Consolidated Lodging Facility, US Air Force Reserve Station, Minneapolis, MN" as an attachment to the end of the section, (the entire attachment is for information only).

6) Section 07421 Page 6, paragraph 2.2, Revise first sentence to read: "Panels shall have a factory applied manufacturer's standard 2-coat (or 3-coat metallic where indicated in 09915 COLOR SCHEDULE), thermo cured system..."

7) Section 07421 Page 7, paragraph 2.3, Revise last two sentences to read: "All panel corner returns to have envelope design with back-up plates secured with stainless steel pop rivets, and sealed with silicon sealant. Butt joint corner return edges not acceptable."

8) Section 07421 Page 8, paragraph 2.5, Revise paragraph to read: "Fasteners for aluminum panels shall be concealed stainless steel rivets of manufacturer's recommended type to suit application. Fasteners for attaching wall panels to supports shall provide both tensile and shear strength of not less than 3340 N (750 pounds) per fastener and shall be located not less than 1/2" from edge of panel corner returns. Exposed wall fasteners and self-tapping screws are not acceptable."

2. This amendment is a part of the bidding papers and its receipt shall be acknowledged on the Standard Form 1442. All other conditions and requirements of the specifications remain unchanged. If the bids have been mailed prior to receiving this amendment, you will notify the office where bids are opened, in the specified manner, immediately of its receipt and of any changes in your bid occasioned thereby.

a. Hand-Carried Bids shall be delivered to the U.S. Army Corps of Engineers, Omaha District, Contracting Division (Room 301), 106 South 15th Street, Omaha, Nebraska 68102-1618.

b. Mailed Bids shall be addressed as noted in Item 8 on Page 00010-1 of Standard Form 1442.

3. Bids will be received until 2:00 p.m., local time at place of bid opening, 15 Jan 2004.

Attachments: Soils Report

U.S. Army Engineer District, Omaha
Corps of Engineers
106 South 15th Street
Omaha, Nebraska 68102-1618

8 Jan 2004
MFS/4411

GEOTECHNICAL EXPLORATION AND REVIEW
FOR
CONSOLIDATED LODGING FACILITY
U.S. AIR FORCE RESERVE STATION
MINNEAPOLIS, MINNESOTA

AET #02-01042

SUMMARY

Purpose
A new Lodging Facility is proposed to be constructed at the U.S. Air Force Reserve Station in Minneapolis, Minnesota. The purpose of our work on this project was to explore subsurface conditions and provide geotechnical engineering recommendations to assist you and the project team in planning and construction.

Scope
To accomplish the above purpose, you have authorized our firm to drill 23 test borings at the site, conduct soil index testing and prepare this geotechnical engineering report.

Findings
The site geology consists of about 2' to 4' of clayey topsoil to fine/mixed alluvium overlying coarse alluvial sandy soils, with glacial tills appearing at depth. Fill appears over the native soils, with a thickness ranging from ½' to 10½'. The topsoil/clay alluvium is not present in thicker fill areas. The fill is mostly a silty sand/clayey sand mixture, which was not placed in a controlled manner. Much of the fill is dark colored (suggesting some organic content), and the fill includes sporadic wet zones and occasional debris. The ground water level is about 12½' to 14' deep.

Recommendations
These recommendations are condensed for your convenience. Study our entire report for detailed recommendations.

- Grading for building support should include excavating the fill, topsoil and fine/mixed alluvium, thereby exposing coarse alluvial sandy soils. The coarse alluvium should be surface compacted prior to fill or footing placement.
- Grades can then be attained where needed with engineered fill. Most of the soils being excavated will be unsuitable for reuse as fill, particularly below foundation areas. If portions of the brown silty/clayey sands are salvaged, moisture conditioning may be needed; and reuse should be done under the full-time observation of a geotechnical technician.
- The building can be supported on conventional spread foundations, designed for an allowable soil bearing capacity of 4,000 psf.
- To prepare pavement subgrades, unstable clayey/silty soils present within the upper 3' subgrade zone should be reworked as needed. Stability is best judged using a test roll process. The use of a sand subbase as the upper subgrade zone should improve constructability and long-term pavement performance.

INTRODUCTION

This report presents the results of a subsurface exploration program and geotechnical engineering review for the proposed consolidated Lodging Facility at the U.S. Air Force Reserve Station in Minneapolis, Minnesota.

To protect you, American Engineering Testing, Inc. (AET), and the public, we authorize use of opinions and recommendations in this report only by you and your project team for this specific project. Contact us if other uses are intended. Even though this report is not intended to provide sufficient information to accurately determine quantities and locations of particular materials, we recommend that your potential contractors be advised of the report availability.

Scope of Services

The original scope is outlined in our October 9, 1998 proposal letter. Authorization to proceed with these services was received through the signed proposal acceptance of Mr. Peter Vesterholt, dated February 3, 1999. At the time of proposal acceptance, however, the scope was slightly changed from the original proposal, and the final scope includes the following:

- Seventeen standard penetration test borings in the proposed building area.
- Seven flight auger test borings in proposed pavement areas.
- Soil laboratory testing (sieve analysis and water content).
- Geotechnical engineering analysis based on the above and preparation of this report.

PROJECT INFORMATION

The project involves constructing a new lodging facility, located to the south of 2nd Street and to the west of Kittyhawk Avenue. The proposed building layout appears on Figure 1. We understand the structure will be a multi-level building which will not include a basement.

Proposed on-grade slab elevation is not available at this time, although we understand it will be relatively close to the existing grade at the site.

Based on information from your structural engineer, we understand maximum column loads will be on the order of 300 kips. Masonry bearing walls will also be constructed, with maximum loads on the order of 20 kips per lineal foot.

Parking lots will be constructed to the north and south of the building, as shown on Figure 1. We understand these pavements are intended for light duty traffic such as automobiles and light passenger type trucks.

We understand the project will be constructed in phases. We understand the initial phase will include the central building portion (defined by Borings #11 to 15), and the parking lot on the south side (defined by Borings #22 to 24). The remainder of the project will be constructed in future phases.

Foundation Design Assumptions

Our spread foundation design assumptions include a minimum factor of safety of 3 with respect to a shear or base failure of the foundations. We assume the structure will be able to tolerate total settlements of up to 1", and differential settlements over a 30' length of up to ½".

The presented project information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

SITE CONDITIONS

Subsurface Soils/Geology

Logs of the test borings are included in Appendix A. The logs contain information concerning soil layering, soil classification, geologic description and moisture. Relative density or consistency is also noted, which is based on the standard penetration resistance (N-value).

The boring logs only indicate the subsurface conditions at the sampled locations and variations often occur between and beyond borings.

The site has undergone some uncontrolled filling. The fill has varying depths, ranging from ½' to 10½' at the test locations. The fill is predominantly silty sand and clayey sand, although also includes some lean clay, silt and sand. Significant portions of the fill are dark colored suggesting at least a little organic content. Although some darker colored soils may not be significantly organic, other portions are significantly organic; and control of separating these varying organic content soils can be extremely difficult during earthwork. Some construction type debris is also occasionally present in the fill, such as concrete, wood, plastic, etc. Some zones of the fill are also relatively wet as compared to "optimum" water content.

The underlying natural profile includes coarse alluvial sandy soils over glacially deposited tills. Many of the borings also include topsoil and fine/mixed alluvial clayey soils at the top of the natural profile, although these layers are absent in areas of deeper fill.

The glacial tills are present at least 14' beneath the surface. The tills are predominantly clayey sand, and have varying consistency based on N-values. Although very soft and soft till zones are indicated, based on N-values, we judge that the consolidation properties of the till soils are more favorable than the N-values would indicate.

Boring #7 indicates the presence of organic laminations within the sand below a depth of 12½'. This condition was not noted at any of the remaining boring locations. The extent of organic laminations at this location does not appear to be extensive enough to create significant consolidation potential.

Water Level Measurements

The boreholes were probed for the presence of ground water, and water level measurements were taken. The measurements are recorded on the boring logs. A discussion of the water level measurement methods is presented in the SUBSURFACE EXPLORATION section of this report.

> Ground water levels usually fluctuate. Fluctuations occur due to varying seasonal and yearly rainfall and snow melt, as well as other factors.

The shallow auger borings within the parking lot areas did not extend deep enough to reach the ground water table. At the remaining locations, water levels were measured at depths of approximately 12½' to 14' beneath the surface. This corresponds to a metric elevation range of 248.23m to 248.57m. As these water levels were measured within relatively free draining sandy soils, the recorded levels should provide a reasonably true indication of the ground water table at that time and location.

GEOTECHNICAL CONSIDERATIONS

The following geotechnical considerations are the basis for the recommendations presented later in this report.

Review of Soil Properties

Strength/Compressibility

The fill soils are mixed, include zones of relatively low N-values, and were not placed in a controlled manner with the intent of supporting structural load. These fill soils are judged to be too weak and compressible to properly support the planned structure. The topsoil and much of the fine/mixed alluvial soils are also judged to have limited strength and compressibility properties.

The coarse alluvial sandy soils have more favorable strength and are relatively low in compressibility. Although loose zones are present, it will be possible to surface compact the exposed sands to improve density. With vibratory surface compaction, we judge that the coarse alluvium is capable of supporting allowable bearing pressures of at least 4,000 psf. Even though some of the fine/mixed alluvial soils are relatively stiff, it will be necessary to remove these materials to allow effective compaction of the underlying coarse alluvium.

The glacial tills (which are at least 14' beneath the surface) appear to have limited strength, based on N-values. At the depths encountered, soil shear strength will not be a significant issue. In our opinion, the consolidation properties of these tills are more favorable than that indicated by the N-values. We judge the low N-values of these overconsolidated tills are a result of temporary hydrostatic weakening when sampled below the water table.

Drainage

The fill is a mixture of varying soil types, and therefore has varying permeability properties (fast to slow draining). The topsoil and fine/mixed alluvial soils are relatively slow draining. On the other hand, the coarse alluvium is fast to moderately fast draining soil. The glacial tills at depth are judged to be moderately slow to slow draining.

Frost Susceptibility

The coarse alluvial soils classified as sand or sand with silt are judged to be low in frost heave potential. The remaining soils are judged to be moderate to moderately high in frost heave potential. These properties should be considered in your design of exterior slabs/stoops, particularly in doorway areas.

RECOMMENDATIONS

Building Grading

Excavation

To prepare the building area for foundation and floor slab support, we recommend excavation of the fill, topsoil and fine/mixed alluvium. This recommendation results in excavation depths on the order of 4' to 10½' beneath the existing surface at the test boring locations. We refer you to Table A in the Appendix for specific recommended excavation depths and elevations at each test boring location.

Where engineered fill is needed to establish foundation grade, the excavation bottom and subsequent fill system should maintain 1:1 lateral oversizing. That is, for each vertical foot of fill placed below the footing/foundation pad, the excavation bottom should be extended laterally beyond the foundation edges an equal distance.

Compaction

We recommend the exposed coarse alluvial sands be surface compacted with at least six passes of a vibratory roller compactor (3' minimum drum diameter). This compaction process will improve near surface density and uniformity prior to fill and footing construction. If finer grained or higher silt content sands are wet at the time of compaction, some subcutting or in-place drying may be needed.

Excavation Observations

Because conditions can be expected to vary between test locations, we recommend that a geotechnical engineer observe and evaluate the excavation bottom after surface compaction has been performed, but prior to any new fill or footing placement.

Filling

We recommend fill placed below footing grades be compacted in thin lifts to a minimum of 98% of the Standard Proctor density (ASTM:D698). With 4,000 psf loadings, we recommend the engineered fill contain no greater than 50% by weight passing the #200 sieve. This recommendation would allow the use of sands, sands with silt, silty sands and clayey sands.

Fill placed to support the floor slab only (above footing grade) should be compacted in thin lifts to a minimum of 95% of the Standard Proctor Density (ASTM:D698). Below slab areas, soils having fines (-#200 content) exceeding 50% could be used, provided they can attain compaction and are non-expansive (no expansive soils were noted on site).

The fill lift thicknesses should be thin enough such that the entire thickness of fill placed can meet the minimum specified compaction level.

In our opinion, many of the on-site soils will not be suitable for reuse as structural fill, particularly below footings. Many of the soils are dark colored, and in the mixed condition, it will be difficult to properly discard overly organic soils. Also, some of the fill includes debris which would also need to be separated. Finally, many zones of fill (usually the more clayey and silty soils) are relatively wet, and would require controlled moisture conditioning in order to attain compaction in a uniform manner.

Where engineered fill is placed on sloping ground (4:1 or steeper), we recommend the excavation bottom be benched or terraced into the slope (parallel to the ground contour) prior to fill placement.

Spread Foundations

The structure can be supported on conventional spread foundations placed directly on the surface compacted natural sands, or on new engineered fill overlying the compacted natural sands. We recommend the perimeter foundations for heated building areas be placed such that the bottom is a minimum of 42" below exterior grade for frost protection. Interior foundations in heated areas or perimeter foundations which have at least 42" of soil cover on the exterior side can be placed directly below the floor slab. Exterior foundations (those foundations not bordering heated building areas) should be extended to a minimum of 60" below exterior grade. Canopy foundations would be considered "exterior" foundations requiring the 60" soil cover depth.

It is our opinion the building foundations can be designed based on a maximum allowable soil bearing pressure of 4,000 psf. It is our judgment this foundation design should include a factor of safety of at least 3 against shear or base failure. We judge that total settlements under the building loads should not exceed 1". We also judge that differential settlements of conditions depicted by the borings after the recommended compaction should not exceed ½".

For your design of sliding resistance, we estimate a coefficient of friction between the on-site soils and mass concrete to be at least 0.35.

Floor Slabs

Any new fill placed to attain floor slab subgrade, including utility and foundation trench backfill, should be compacted to a minimum of 95% of the Standard Proctor density.

We estimate the clayey on-site soils should provide a Modulus of Subgrade Reaction (k-value) of at least 150 psi per inch. This can be improved to a k-value of 200 psi per inch if floor subgrade soils are limited to silty sands or cleaner.

We recommend providing a 6" thick continuous sand cushion layer directly below the floor slab to prevent capillary rise to the slab. This sand should contain less than 5% by weight passing the #200 sieve, and less than 40% passing the #40 sieve. This generally refers to (SP) sands which are mostly medium grained.

Where moisture sensitive floor coverings are planned, we recommend the use of a polyethylene vapor membrane to reduce vapor transmission. Some floor coverings require a vapor membrane to keep their warranty intact. From a slab curling standpoint, it would be preferable to place the vapor membrane below the sand cushion. However, we caution that membrane placement below the cushion could pose constructability difficulties. Also, it is preferred that the slab area not be exposed to rain or other means of water infiltration at the time the cushion is exposed (due to water trapping in the sand above the membrane).

Building Backfilling

Our recommendations for backfilling the structure appear on two standard data sheets which we have attached to this report. These sheets are entitled:

- "Freezing Weather Effects on Building Construction"
- "Basement/Retaining Wall Backfill and Water Control"

These sheets present information on preferred soil types, frost considerations, drainage and lateral pressures. We recognize that the proposed building will not include a basement, although this sheet is being provided in the event you have exterior retaining walls or below grade spaces, such as heating ducts.

Pavement Subgrade Preparation

To prepare pavement subgrades, we recommend stripping any surficial organic soils, and excavating to subgrade where needed. The exposed soils should then be evaluated for stability, preferably by means of test rolling. Test rolling is described on the attached sheet entitled "Bituminous Pavement Subgrade Preparation and Design." Where excessive rutting or yielding is noted under the test roll, additional subcutting and replacement, or in-place scarification, drying, and recompaction should take place until stability can be gained. If there are areas where the exposed soils are greater than 3' beneath final subgrade elevation (figured as the contact with the bottom of the aggregate base), then scarification and drying should not be necessary. The exception would be in the case of excessive instability, where the poor condition limits the ability to compact the fill placed above these soils.

The soils present in proposed pavement areas are relatively poor draining and frost susceptible materials. Even if properly stabilized, these soil types can result in premature pavement failure and increased maintenance costs due to frost-related distress. To aid in reducing this type of distress, you should consider the placement of a sand subbase as the top of subgrade. In this case, we would recommend a minimum thickness of 1' (and greater thicknesses would provide increased performance). If a subbase is used, the stability evaluation process described above should be performed at the subcut bottom (prior to sand subbase placement).

We recommend sand subbase material at least consist of a "Select Granular Borrow" per Mn/DOT Specification 3149.2B2. This specification requires that the soils contain less than 12% by weight passing the #200 sieve (SP or SP-SM designation). If available at a reasonable cost, it would be preferable to use a "Modified Select Granular Borrow." We define this material as a sand having less than 5% by weight passing the #200 sieve and less than 40% passing the #40 sieve. This would be a mostly medium grained (SP) sand. This soil is more free draining and maintains better stability when saturated as compared to finer grained soils.

Except for organic soils and overly wet soils, the on-site soils can be reused as subgrade fill. With clayey/silty soils, you should anticipate that some moisture conditioning will be needed to attain compaction and proper stability. If a sand subbase is used, the on-site materials not meeting subbase requirements can be used within subcuts up to the bottom of subbase grade.

Compaction of new fill should meet the requirements of Mn/DOT Specification 2105.3F1 (Specified Density Method). This specification requires soils placed within the upper one meter (3' can be used) of subgrade be compacted to a minimum of 100% of the Standard Proctor density (ASTM:D698). This specification also includes water content range requirements (65% to 102% of the optimum water content condition). Soils placed below the upper one meter (or 3') zone can have a reduced minimum compaction level of 95%.

If a sand subbase layer is used, it should be provided with a means of subsurface drainage. The use of Modified Select Granular Borrow will allow more favorable migration of water to low elevation areas. With sufficient sloping, and the freer draining sand, draintile lines in low elevation points should be sufficient. With slower draining sands and less sloping, more extensive draintile lines would be needed.

Subsurface drainage can also improve performance where pavement designs do not include sand subbase layers. In this case, draintile line placement around the perimeter of the paved surface can aid in preventing water from infiltrating beneath the pavement from exterior areas.

Pavement Thickness Designs

We estimate the on-site silty sands/clayey sands (the predominant upper subgrade soils) have an R-value on the order of 20. By placing a 1' thick sand subbase, it is our judgment the equivalent R-value will be improved to 35. Based on light duty traffic, and the assumed R-values, we offer the following pavement thickness designs:

Material	No Subbase	With 1' Subbase
Bituminous Wear (Type 41)	1½"	1½"
Bituminous Base (Type 31)	1½"	1½"
Class 5 Aggregate Base (Mn/DOT 3138)	6"	4"

CONSTRUCTION CONSIDERATIONS

Construction Difficulties

The on-site inorganic soils available for fill may be too wet or dry, thereby requiring moisture conditioning if they are to be reused as engineered fill. Soils containing organic content, roots, and/or debris should be avoided.

The on-site soils can contain cobbles and boulders which can complicate excavation and filling.

Excavation Sidesloping

If unretained, the excavation should maintain sideslopes in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." Even with the required OSHA sloping, ground water can potentially induce sideslope erosion or running which could require slope maintenance.

Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by a geotechnical engineer/technician during construction to evaluate these potential changes. Soil density testing should also be performed on new fill placed in order to document that project specifications for compaction have been satisfied. If on-site soils are reused as structural fill, we recommend fill type selection and compaction be monitored by a geotechnical technician on a full-time basis.

SUBSURFACE EXPLORATION

General

The geotechnical exploration program for the project consisted of 17 standard penetration test borings and 7 flight auger test borings which were drilled at the site on February 16 to 19, 1999. The boring locations appear on Figure 1 in the appendix. The boring locations were surveyed and staked in the field by Enviroscience prior to drilling. Surface elevations were also provided by Enviroscience. Due to an existing utility, Boring #10 was drilled 6' east of the staked location.

Drilling Methods

The standard penetration test borings were drilled using 3.25" inside diameter hollow stem augers. The auger borings were drilled with a 6" diameter flight auger.

Sampling Methods

Split-Spoon Samples (SS)

Standard penetration (split-spoon) samples were collected in general accordance with ASTM:D1586. This method consists of driving a 2" O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30". The sampler is driven a total of 18" into the soil. After an initial set of 6", the number of hammer blows to drive the sampler the final 12" is known as the standard penetration resistance or N-value.

Disturbed Samples (DS)

Some samples were taken directly from the flights of the auger (the upper frozen zone of the penetration borings and the flight auger borings). In this case, the samples retrieved are disturbed, and data gained is less accurate than split-spoon sampling.

Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Classification Methods

Soil classifications shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM:D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, classifications per ASTM:D2487 are possible. Otherwise, soil classifications shown on the boring logs are visual-manual judgments. We have attached charts (Appendix A) illustrating the USC system, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include judgments of the geologic depositional origin. This judgment is primarily based on observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation and development can sometimes aid this judgment.

Water Level Measurements

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

Sample Storage

We will retain representative samples of the soils recovered from the borings for a period of 30 days. The samples will then be discarded unless you notify us otherwise.

LIMITATIONS

The data derived through the exploration program have been used to develop our opinions about the subsurface conditions at your site. However, because no exploration program can reveal totally what is in the subsurface, conditions between borings and between samples and at other times, may differ from conditions described in this report. The exploration we conducted identified subsurface conditions only at those points where we took samples or observed ground water conditions. Depending on the sampling methods and sampling frequency, every soil layer may not be observed, and some materials or layers which are present in the ground may not be noted on the boring logs.

If conditions encountered during construction differ from those indicated by our borings, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

The extent and detail of information about the subsurface condition is directly related to the scope of the exploration. It should be understood, therefore, that information can be obtained by means of additional exploration.

STANDARD OF CARE

Our services for your project have been conducted to those standards considered normal for services of this type at this time and location. Other than this, no warranty, either express or implied, is intended.

SIGNATURES

Report Prepared by:

Jeffery K. Voyen, PE
Vice President, Geotechnical Division
MN Reg. #15928

Report Reviewed by:

James C. Rudd, PE
Principal Engineer

BASEMENT/RETAINING WALL BACKFILL AND WATER CONTROL

DRAINAGE

Below grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior daylighting, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, damp/water proofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2', and then upward and outward from the wall at a 30° or greater angle from vertical. The sands should contain no greater than 12% by weight passing the #200 sieve, which would include (SP) and (SP-SM) soils. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slab/pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

LATERAL PRESSURES

Lateral earth pressures on below grade walls vary, depending on backfill soil classification, backfill compaction and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the standard Proctor density and a level ground surface.

Soil Type	Equivalent Fluid Density Active (pcf)	Equivalent Fluid Density At-Rest (pcf)
Sands (SP or SP-SM)	30	45
Silty Sands (SM)	40	60
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the "at-rest" pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about ¼" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which includes tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

BITUMINOUS PAVEMENT SUBGRADE PREPARATION AND DESIGN

GENERAL

Bituminous pavements are considered layered "flexible" systems. Dynamic wheel loads transmit high local stresses through the bituminous/base onto the subgrade. Because of this, the upper portion of the subgrade requires high strength/stability to reduce deflection and fatigue of the bituminous/base system. The wheel load intensity dissipates through the subgrade such that the high level of soil stability is usually not needed below about 2' to 4' (depending on the anticipated traffic and underlying soil conditions). This is the primary reason for specifying a higher level of compaction within the upper subgrade zone versus the lower portion. Moderate compaction is usually desired below the upper critical zone, primarily to avoid settlements/sags of the roadway. However, if the soils present below the upper 3' subgrade zone are unstable, attempts to properly compact the upper 3' zone to the 100% level may be difficult or not possible. Therefore, control of moisture just below the 3' level may be needed to provide a non-yielding base upon which to compact the upper subgrade soils.

Long-term pavement performance is dependent on the soil subgrade drainage and frost characteristics. Poor to moderate draining soils tend to be susceptible to frost heave and subsequent weakening upon thaw. This condition can result in irregular frost movements and "popouts," as well as an accelerated softening of the subgrade. Frost problems become more pronounced when the subgrade is layered with soils of varying permeability. In this situation, the free-draining soils provide a pathway and reservoir for water infiltration which exaggerates the movements. The placement of a well drained sand subbase layer as the top of subgrade can minimize trapped water, smooth frost movements and significantly reduce subgrade softening. In wet, layered and/or poor drainage situations, the long-term performance gain should be significant. If a sand subbase is placed, we recommend it be a "Select Granular Borrow" which meets Mn/DOT Specification 3149.2B.

PREPARATION

Subgrade preparation should include stripping surficial vegetation and organic soils. Where the exposed soils are within the upper "critical" subgrade zone (generally 2½' deep for "auto only" areas and 3' deep for "heavy duty" areas), they should be evaluated for stability. Excavation equipment may make such areas obvious due to deflection and rutting patterns. Final evaluation of soils within the critical subgrade zone should be done by test rolling with heavy rubber-tired construction equipment, such as a loaded dump truck. Soils which rut or deflect 1" or more under the test roll should be corrected by either subcutting and replacement; or by scarification, drying, and recompaction. Reworked soils and new fill should be compacted per the "Specified Density Method" outlined in Mn/DOT Specification 2105.3F1.

Subgrade preparation scheduling can be an important consideration. Fall and Spring seasons usually have unfavorable weather for soil drying. Stabilizing non-sand subgrades during these seasons may be difficult, and attempts often result in compromising the pavement quality. Where construction scheduling requires subgrade preparation during these times, the use of a sand subbase becomes even more beneficial for constructability reasons.

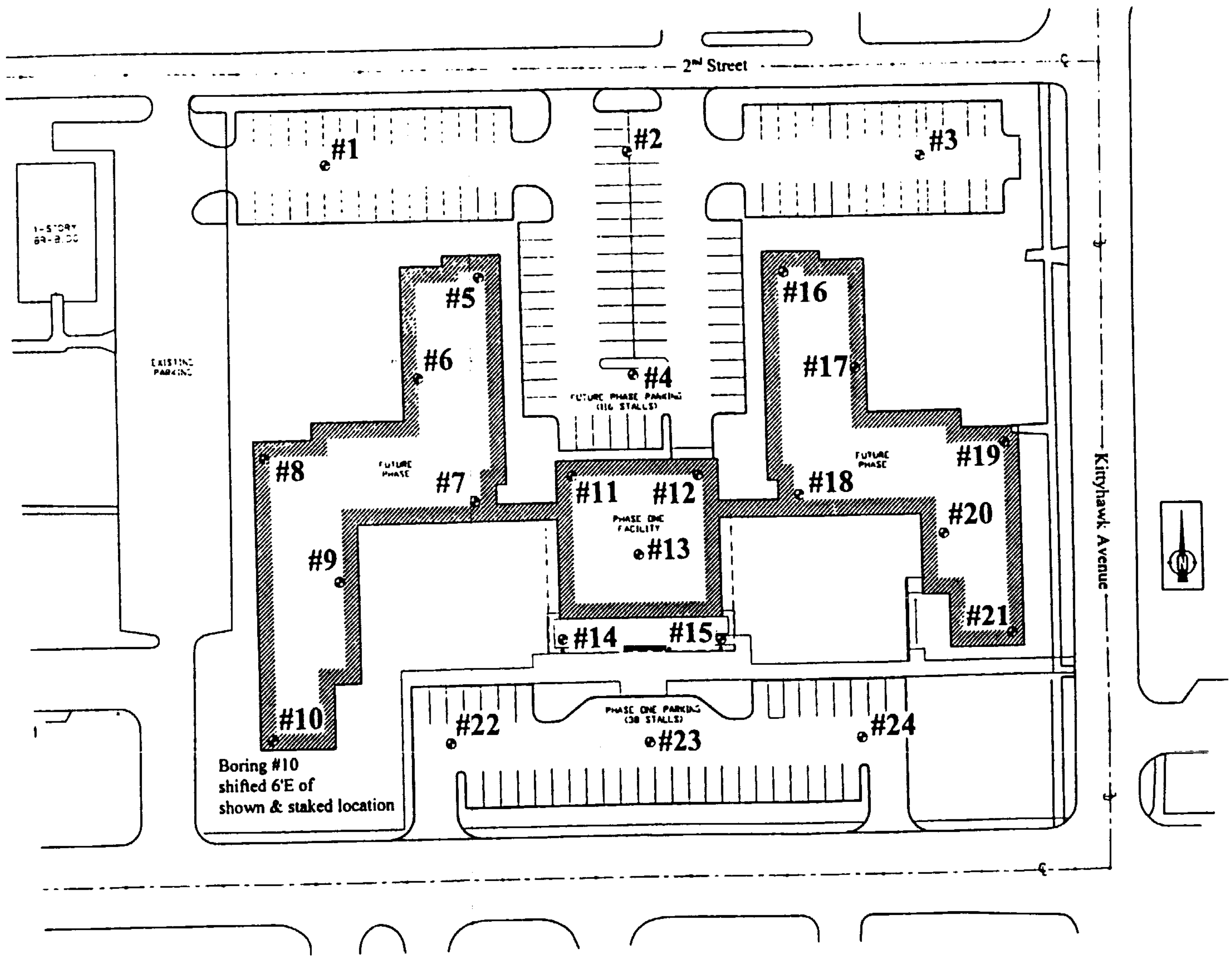
SUBGRADE DRAINAGE

If a sand subbase layer is used, it should be provided with a means of subsurface drainage to prevent water build-up. This can be in the form of draintile lines which tap into storm sewer systems, or outlets into ditches. Where sand subbase layers include sufficient sloping, and water can migrate to lower areas, draintile lines can be limited to finger drains at the catch basins. Even if a sand layer is not placed, strategically placed draintile lines can aid in improving pavement performance. This would be most important in areas where adjacent non-paved areas slope towards the pavement. Perimeter edge drains can aid in intercepting water which may infiltrate below the pavement.

Appendix A

Table A - Recommended Excavation Depths/Elevations
Figure 1 - Boring Locations
Soil Boring Logs
Sieve Analysis Test Results
Boring Log Notes
Classification of Soils for Engineering Purposes
General Terminology Notes

TABLE A Consolidated Lodging Facility US Air Force Reserve Station Minneapolis, Minnesota AET #02-01042		
Boring Number	Recommended Excavation Depths for 4000 psf	Excavation Elevation (metric)
5	9' (2.74m)	249.6
6	6½' (1.98m)	250.3
7	5½' (1.68m)	250.7
8	5' (1.52m)	250.9
9	5' (1.52m)	250.8
10	4' (1.22m)	251.1
11	10½' (3.20m)	249.4
12	6½' (1.98m)	250.6
13	9' (2.74m)	249.7
14	10½' (3.20m)	249.2
15	5½' (1.68m)	250.7
16	8' (2.44m)	250.2
17	7' (2.13m)	250.5
18	6½' (1.98m)	250.6
19	5' (1.52m)	250.9
20	5' (1.52m)	251.0
21	4' (1.22m)	251.2



AMERICAN ENGINEERING TESTING, INC.	**PROJECT** Consolidated Lodging Facility, US Air Force Reserve Station, Minneapolis, Minnesota			**AET JOB NO.** 02-01042
	SUBJECT Boring Locations			**DATE** March 1, 1999
	SCALE n/a	**DRAWN BY** provided/reduced	**CHECKED BY** -	**Figure 1**

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 02-01042

LOG OF BORING NO. 1 (p. 1 of 1)

PROJECT: Consolidated Lodging Facility, US Air Force Reserve Station; Minneapolis, MN

SURFACE ELEVATION: 252.48

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC. IN.	WC	DEN	LL	PL	%-200
				F/M	DS						
1–2	Fill, mixture of silty sand and clayey sand, dark brown	FILL									
3	Silty sand, fine grained, brown, moist (SM) (may be fill)	COARSE ALLUVIUM*		M	DS						
4	Lean clay, brown (CL)	FINE ALLUVIUM		M	DS						
5–9	Silty sand, fine grained, light brown and brown mottled, moist (SM)	COARSE ALLUVIUM		M	DS						
	END OF BORING	*OR FILL									

DEPTH:	DRILLING METHOD
0-9.5'	6" FA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
2/19/99	11:35	9.5	None	9.0		None

BORING COMPLETED: 2/19/99

CC: CB CA: SS Rig: 33

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 02-01042 LOG OF BORING NO. 5 (p. 1 of 1)

PROJECT: Consolidated Lodging Facility, US Air Force Reserve Station; Minneapolis, MN

DEPTH IN FEET	SURFACE ELEVATION: 252.38 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC. IN.	WC	DEN	LL	PL	%-200
				F	DS						
0–9	Fill, mostly silty sand, a little gravel, clayey sand, lean clay and wood, dark brown and brown	FILL	11	M	SS	1					
			3	M	SS	10					
			3	M	SS	14					
9–11	Sand, fine grained, light brown, moist, loose (SP)	COARSE ALLUVIUM	10	M	SS	18					
11–14	Sand with silt and a little gravel, fine to medium grained, brown, moist to about 12.5' then waterbearing, loose (SP-SM)		7	M/W	SS	14					
14–17.5	Sand with a little gravel, medium grained, brown, waterbearing, loose (SP)		8	W	SS	18					
17.5–21	Clayey sand with a little gravel, gray, soft (SC)	TILL	4	M	SS	18					
21	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-19.5'	3.25" HSA							
		2/18/99	10:05	13.5	12.0	13.5		12.7
		2/18/99	10:15	21.0	19.5	20.8		19.5

BORING COMPLETED: 2/18/99

CC: CB CA: SS Rig: 33

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

2/99

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 02-01042 LOG OF BORING NO. 6 (p. 1 of 1)

PROJECT: Consolidated Lodging Facility, US Air Force Reserve Station; Minneapolis, MN

SURFACE ELEVATION: 252.34

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC. IN.	WC	DEN	LL	PL	%-200
0–4	Fill, mostly silty sand, a little gravel and silt, dark brown and brown	FILL		F	DS						
			7	M	SS	18					
4–6.5	Lean clay, brown, medium (CL)	FINE ALLUVIUM	5	M	SS	14					
6.5–14	Sand, fine grained, light brown, moist to about 12.5' then waterbearing, loose to medium dense, a few lenses of silty sand below about 12' (SP)	COARSE ALLUVIUM	5	M	SS	18					
			8	M	SS	16					
			11	M-W	SS	18					
14–17.5	Sand with silt and a little gravel, medium grained, brown, waterbearing, medium dense (SP-SM)		17	W	SS	18					
17.5–21	Clayey sand with a little gravel, gray, medium (SC)	TILL	6	M	SS	18					
21	END OF BORING										

DEPTH:	DRILLING METHOD
0-19.5'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
2/18/99	10:50	13.5	12.0	13.5		12.7
2/18/99	11:00	21.0	19.5	21.0		18.5

BORING COMPLETED: 2/18/99

CC: CB CA: SS Rig: 33

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **02-01042** LOG OF BORING NO. **8 (p. 1 of 1)**

PROJECT: **Consolidated Lodging Facility, US Air Force Reserve Station; Minneapolis, MN**

SURFACE ELEVATION: **252.47**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC. IN.	WC	DEN	LL	PL	%-200
0–2	Fill, mixture of silty sand and clayey sand, dark brown and light brown	FILL		F	DS						
2–3	Silty sand, fine grained, dark brown, moist, loose (SM)	TOPSOIL	6	M	SS	18					
3–3.5	Silty sand, fine grained, brown, moist, loose (SM)	COARSE*									
3.5–5	Lean clay, brown, medium (CL)	FINE ALLUVIUM									
5–6.5	Sand with silt, fine grained, light brown, moist, loose (SP-SM)		10	M	SS	18					
6.5–13	Sand, fine to medium grained, light brown, moist, loose to medium dense (SP)	COARSE ALLUVIUM	5	M	SS	14					
			8	M	SS	18					
			12	M	SS	18					
13–14	Sand with a little gravel, medium grained, light brown, moist to about 13.5' then waterbearing, medium dense (SP)										
14–15.5	Sand with silt and a little gravel, fine to medium grained, brown, waterbearing, medium dense (SP-SM)		12	W	SS	18					
15.5–21	Clayey sand with a little gravel, brown to gray, stiff to medium (SC)	TILL	6	M	SS	18					
21	**END OF BORING**	*ALLUVIUM									

DEPTH:	DRILLING METHOD
0-19.5'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
2/18/99	12:35	13.5	12.0	13.5		13.4

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

BORING COMPLETED: 2/18/99

CC: CB CA: SS Rig: 33